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SUGAR PRICES FOR MONTH ENDING JANUARY 12, 1909.

		Centrifugals.	Beets.	Parity.
December	9	3.86¢	10s	4.11¢
"	10	3.86¢	10s	4.11¢
"	11	3.86¢	10s	4.11¢
"	12	3.86¢	10s	4.11¢
"	14	3.80¢	10s	4.11¢
"	15	3.80¢	10s 1½d	4.14¢
"	16	3.77¢	10s	4.11¢
"	17	3.77¢	10s	4.11¢
"	18	3.73¢	10s	4.11¢
"	19	3.73¢	10s 0¾d	4.12¢
"	21	3.70¢	10s	4.11¢
"	22	3.70¢	10s	4.11¢
"	23	3.67¢	10s 0¾d	4.12¢
"	24	3.67¢	10s 0¾d	4.12¢
"	25	3.67¢	10s 0¾d	4.12¢
"	26	3.67¢	10s 0¾d	4.12¢
"	28	3.70¢	9s 11¼d	4.09¢
"	29	3.67¢	10s 0¾d	4.12¢
"	30	3.67¢	10s 3d	4.16¢
"	31	3.67¢	10s	4.11¢
January	1	3.67¢	10s	4.11¢
"	2	3.67¢	10s	4.11¢
"	4	3.70¢	10s 0¼d	4.12¢
"	5	3.70¢	10s 1½d	4.14¢
"	6	3.70¢	10s 1½d	4.14¢
"	7	3.73¢	10s 0¾d	4.12¢
"	8	3.73¢	10s 0¾d	4.12¢
"	9	3.73¢	10s 1½d	4.14¢
"	11	3.73¢	10s 1½d	4.14¢
"	12	3.74¢	10s 2¼d	4.15¢

Messrs. Willet & Gray in their "Weekly Statistical" of December 24, state:

RAWS.—As usual, the last week of the year is quiet, with little disposition to do business, several refineries being closed for annual cleaning up. The last sale leaves the closing quotation of the year at 3.67c. per pound, 96° test.

We give our usual review of prices for the year, showing highest for Centrifugals, 4.49c. per pound; lowest, 3.67c. per pound; and average for 1908, 4.073c. per pound.

The average for refined for 1908 was 4.957c. per pound; the average difference between raw and refined .884c. per pound.

Europe closes with beet sugar at 10s. 3d., say 2¼d. advance for December, but unchanged for January at 10s. 1½d.

Cubas for January-February shipments are offered at 2 5-16c. c. & f, 96° test, without interesting buyers. The work of harvesting is progressing, there now being 48 Centrals grinding, against 33 last week; but receipts are still small. Crop estimates are given in another column.

The American beet crop was so badly damaged by the drought in some sections early in the season, that we have been obliged to reduce our estimate of the total out-turn from 440,000 tons to 390,000 tons, as we stated on October 22d might be expected.

RAW SUGAR PRICE REVIEW, 1908.—The year opened with Centrifugals, 96° test basis (the standard for raw sugars), at 3.85c. per pound, declining to 3.75c. at close of January. The decline continued until the middle of February to 3.67c. per pound, the lowest point of the year; March showed an improvement to 4.36c. per pound at the close; April 21st marked the high point of the year at 4.49c. per pound; May declined to 4.24c. per pound; June fluctuated between 4.36c. and 4.25c.; July 4.39c. to 4.25c.; August, 4.125c. to 3.90c.; September, 3.90c. to 3.98c.; October, 3.98c. to 4.04c.; November steady at 3.95c. to 3.94c.; December, 3.92c. to 3.67c.—closing the year at 3.67c. per pound.

The lowest point of the year was February 20th at 3.67c. per pound, and highest point April 21st at 4.49c. per pound.

The average price of Centrifugals for the year 1908 was 4.073c. per pound, against 3.756c. per pound in 1907; 3.686c. in 1906; 4.278c. in 1905; 3.974c. in 1904; 3.72c. in 1903; 3.542c. in 1902; 4.047c. in 1901; 4.566c. in 1900; 4.419c. in 1899. The average price for Centrifugals for ten years was 4.006c. per pound, duty paid. The higest price for Centrifugals since July, 1897, was 5.125c. in March, 1905, and the lowest price, 3.25c., in June, 1902.

Duties in 1909 are likely to be changed to the extent of admitting 300,000 tons sugar free of duty from the Philippine Islands.

In our last annual review of prices we said for the year 1908 the average price of raw sugar should be rather higher than in 1907. The result shows .317c. per pound higher.

For 1909, in view of larger cane supplies and possible change of duties, the average should be lower than 1908.

Prices of Cuba Centrifugals in 1908 on the cost and freight basis opened at 2.49c. per pound; declined to 2.31c. in February, advanced to 2.765c. in March, further advanced to 3.125c. in April, declined to 2.88c. in May, advanced to 3.04c. in June, declined to 2.54c. in August, advanced to 2.68c. in October, declined to 2.31c. net cash in December at close of year. The average cost and freight price for 96° Centrifugals in 1908 was 2.713c. per pound net cash.

CUBA CROP ESTIMATE.—Messrs. Joaquin Guma-Frederico Mejer cabled us on 24th inst. their estimate of the new Cuba crop at 1,397,500 tons sugar. Their first estimate of the previous crop was 1,165,000 tons published January 3, 1908.

It is understood that this estimate is based upon the amount of cane in the field and upon normal yield and favorable weather for grinding.

The start is a little later than anticipated and the yield thus far is unsatisfactory, although expected to improve in a few weeks.

In making our crop estimate of 1,250,000 tons, published October 22nd, we allowed "for the possibility of the cane not being as productive as appearances would indicate, after experiencing a protracted drought." When the harvesting of the crop is in full swing, we will ascertain the yield of sugar then being obtained from the cane and will revise our estimate accordingly.

NOTES.

HAWAIIAN CHEMISTS' ASSOCIATION.—A meeting of the Hawaiian Chemists' Association was held January the 9th at the office of the Hawaiian Sugar Planters' Experiment Station. Present were Messrs. Peck, Severance, Hartmann, Johnson, James, Kelly, Norris, Werthmueller, McNeil, Dillingham, Jordan and Greenfield. An interesting paper on "Soil Acidity" was read by Mr. W. P. Kelly of the Hawaii Experiment Station staff, which will appear later in the "Journal of the American Chemical Society." Resolutions were passed thanking Mr. Geo. W. Smith and the University Club for courtesies to the Association at the time of the annual meeting last October.

COMMERCE OF THE PHILIPPINES.—The commerce of the Philippine Islands for the fiscal year ending June 30, 1908, is revealed by statistics just issued by the Bureau of Insular affairs, and are given below together with the figures for the Territory of Hawaii, covering the same period:

	IMPORTS.		
	United States	Foreign	Total
Philippines	$ 5,079,487	$25,838,870	$30,918,357
Hawaii	15,303,325	4,682,399	19,985,724
	EXPORTS.		
	United States	Foreign	Total
Philippines	$10,323,233	$22,493,334	$32,816,567
Hawaii	41,640,815	597,640	42,238,455

INJURIOUS INSECTS IN HAWAII.—Mr. Walter W. Froggatt, government entomologist of New South Wales, who came to Hawaii about a year ago to investigate the value of introduced parasites, or beneficial insects, at a recent meeting of the West Indian Agricultural Conference had the following to say in reference to parasites and beneficial insects in Hawaii:

"I found in Hawaii that scale insects and mealy bugs were just as plentiful upon native bushes and introduced plants as they are in Australia, but as there are practically no commercial orchards in these islands, very little notice is taken of them. All the interest in Hawaii is centered upon the pests that affect sugar-cane, and the work done by the staff of the Sugar Planters' Association has been on such pests. One of the most interesting was the introduction of an egg parasite (a minute parasitic wasp) of the cane leaf-hopper (*Perkinsiella saccharicida*) some three years ago, from the cane fields of Queensland, by Messrs. Koebele and Perkins. The leaf-hopper had been introduced some years before with cane from Queensland, and increased so rapidly that it did a great deal of damage in puncturing the leaves and stems. In less than two years after the introduction of its parasite there was a very marked difference in the ravages of the leaf-hopper, and though there are still plenty of them in the cane fields, the pest may be said to be held in check. At the same time, altered methods of cultivation and the introduction of harder-stemmed varieties of cane may have been factors in its decrease.

"The introduction of at least half a dozen different insects from Mexico to destroy the lantana scrub growing on sugar land was a daring experiment in economic entomology, and could only be attempted in a place like Hawaii, where nearly everything on the islands has been introduced from foreign lands. It had been claimed that the lantana, owing to these insects, was dying in large areas, and in others, was producing no flowers or seeds. I found plenty of evidence of the insects on the lantana foliage; the most active of which was a small leaf bug. This insect, feeding on the underside of the leaves, often defoliated the bushes; but its attacks did not prevent them from throwing out a fresh growth of foliage when the rains set in. Again, this bug is very closely allied to an indigenous species in Australia that causes similar damage to the cultivated olive; it could never be introduced into an orchard country.

"The insect that is killing the lantana is the Indian mealy bug (*Orthesia insignis*) known there as the 'Maui Blight,' which is a very serious pest in other countries to tea and other plants. This was accidentally introduced into the islands many years ago, but has been artificially spread by the planters and cattle men all over the islands."

THE HAWAIIAN SUGAR INDUSTRY IS WHOLLY DEPENDENT UPON ADEQUATELY PROTECTIVE DUTIES.

Appearing before the Committee on Ways and Means to give testimony as to the needs of the sugar growing industry of Hawaii, Mr. F. M. Hatch, representing the Hawaiian Sugar Planters' Association, made the following statement:

The sugar industry of Hawaii today shows an actual investment of over $70,000,000.

The property representing this investment is assessed for taxation purposes in an aggregate sum of $69,200,000.

There are seventy plantations whose shares of stock are widely distributed in individual holdings. The corporate organization has been adopted as a method of coöperation, as well as to secure limited liability of investors. Without the latter the development of an industry involving as much risk as is involved in starting a sugar plantation could not have taken place in a community having so little accumulated capital as Hawaii. The result has been that almost the entire community in Hawaii is interested in, and to a large extent dependent upon, the sugar business; both directly as shareholders, sugar stocks being widely distributed among the people as above pointed out and indirectly through connection with a hundred and one forms of business dependent upon sugar for existence.

Notwithstanding the very promising results expected and to some extent obtained by the new industries now being started in Hawaii, which have excited great local interest, sugar continues the mainstay of the islands. It is the sugar industry which pays the great bulk of the taxes and without which the Territory could not keep up its schools and other institutions, and would, in fact, become speedily insolvent. The vital importance of the upkeep of this industry in Hawaii to the entire population of the islands cannot be too strongly emphasized.

Hawaii is handicapped by heavy cost of production in sugar and by a large marketing expense. Cultivation is intensive, replowing follows every second ratoon crop; irrigation and the fertilizers used add greatly to the cost of production.

The following table shows the capital invested, percentage of profit and dividends paid, with New York prices of raw sugar, for the last five years for which the figures are available. The results in 1907 would not materially change the averages; the returns for 1908 are not yet at hand, but the crop will be larger than in previous years, amounting to 520,000 short tons:

Year	Capital invested	Per cent. profit	Per cent. dividend paid
1902	$63,940,650	1.31	2.75
1903	64,878,931	7.02	2.40
1904	65,431,573	7.02	2.96
1905	66,663,645	12.52	8.71
1906	70,913,798	7.05	6.34
Average		6.984	4.632

Average New York prices of 96 raws have been as follows: 1902, .03542; 1903, .0372; 1904, .03974; 1905, .04278; 1906, .03686; average, .0384.

The five years covered in the above table represent a fair average of the sugar industry in Hawaii; they include the year 1905, when the price of raw reached the highest point in the past ten years. The average price in New York for 96 centrifugal sugars during the five years covered was 3.84 cents; this figure is above the normal price for sugars, and is higher than may reasonably be expected in the next five years under present Tariff conditions.

Sugar is almost the only staple commodity that has not materially advanced in price to the consumer during the life of the Dingley Tariff law. While meat, flour, lumber, shoes, steel products and coal have advanced from 20 to 40 per cent., the average cost of sugar to the actual consumer has remained substantially the same for the past ten years.

The average price of granulated sugar during the first year of the Dingley Tariff was 4.80 cents; the average price during ten years of the Dingley law has been $4.85.

Exaggerated statements are frequently seen in regard to yields and profits in the Hawaiian sugar industry. The average yields of 4.403 short tons per acre for an eighteen months' crop in Hawaii have been made possible by the most scientific and expensive system of agriculture; the milling processes have also been developed until they are the most efficient in the world.

Cuban yields per acre through a ten-year period would be approximately two and a half tons per acre on new lands.

In Hawaii a crop requires 18 months to mature; hence the average yield of an acre of land in ten years would be 29.354 short tons, or an average of 2.935 tons annually. In addition to this time must be lost for frequent replowing and replanting in Hawaii.

Consideration may reasonably be asked for sugar plantations operating under average conditions. The records for the last five-year period show annual profits per hundred pounds of sugar as follows: 12 cents, 54 cents, 62.8 cents, 98.9 cents and 58.8 cents, an average of 57.3 cents.

This demonstrates how relatively small and uncertain the margin of profit is; the wide fluctuations in the world's price of sugar makes the uncertainty even more pronounced.

This average profit on Hawaiian sugar production during the last five-year period of about 57.3 cents per hundred pounds was approximately the same as that of the beet sugar producers of the United States; if the duty had been one-half cent per pound less, the earnings would have been about 7.3 cents per hundred pounds.

A reduction of one-half cent per pound on the sugar Tariff within the last five-year period would have made a decrease of 6.06 per cent. on the total earnings of Hawaiian sugar plantations; this would more than have wiped out all the dividends paid during those years, and would have left the entire industry without any return on the capital invested after allowing for depreciation.

No agricultural or industrial enterprise can reasonably be expected to do business on a smaller margin than 7 per cent. average earnings where there are conditions of hazard such as inevitably exist in the sugar industry.

Any material reduction in the sugar schedules would cause an immediate and crushing loss on existing properties, and a complete demoralization of the commerce and industrial life of Hawaii. Hawaii is practically a one-crop country. No remunerative crop exists to replace sugar if this should have to be abandoned. The capital invested in sugar would become almost a total loss, the most expensive parts of sugar plants not being available for other purposes.

The loss would not be confined to the sugar business; much more than the fate of a single industry is involved, so far as Hawaii is concerned.

A disorganization of the sugar industry would be a public disaster, the effect of which upon the Territory as a whole would be immeasurable.

GOVERNOR FREAR'S REPORT.

The report of the Governor of Hawaii to the Secretary of the Interior for the year ended June 30, 1908, has recently come from the press. Of late years a more economical administration of the Government printing office at Washington has tended to cut down the size of all governmental reports, a policy which, while reducing the operating expense of the printing office, does not assist in the compilation of complete and comprehensive reports. It is quite apparent that Governor Frear's report has been edited and probably much has been eliminated.

Under the heading of "Population, Immigration and Labor" the report says:

"It is nearly eight years since the last census was taken, and the conditions are such that it is difficult to estimate the present population. It is probably about 170,000, divided about as follows: Orientals, 95,000, namely, Japanese 72,000, Chinese 18,000, Koreans 5,000; Latins, 27,000, namely, Portuguese 23,000, Spanish 2,000, Porto Ricans 2,000; Polynesians, practically all Hawaiians and part Hawaiians, 35,000; Teutons, practically all of American, British, German, and Norwegian descent, 12,000; others 1,000.

"The Japanese arrivals and departures have varied greatly. In 1904 and 1905 the departures were nearly double the arrivals, owing to the Japan-Russia war. For several years before that there was little difference. Since then the arrivals have on the whole considerably exceeded the departures, although the tendency is the other way now, owing to restrictions placed by the Japanese Government upon emigration to Hawaii. This tendency is offset to some extent by the restrictions against the migration of Japanese from Hawaii to the Pacific coast. The result is to keep here a better, that is, less adventurous, class of Japanese, to bring Japanese wives here in larger numbers, and to postpone the labor stringency which will come from diminution of arrivals unless some other adequate source of labor is found. During the last year the percentage of females among arrivals was 33.3 per cent., while during the previous year it was only 11.1 per cent. With the increase of Japanese married women, there has been a large increase in Japanese births. During the year ended June 30, 1908, there were 4,593 births, of which more than one-half, namely, 2,445, were Japanese, 674 Hawaiians, 591 Portuguese, 388 Chinese, and 495 others. The Japanese children in the schools have increased from 1,352 out of 15,537 pupils of all races in December, 1900, to 5,513 out of 23,445 pupils in June, 1908. They outnumber the pupils of any other nationality, unless we include part-Hawaiians with Hawaiians, these numbering together 8,123. The continued decrease in the Chinese population, due to departures and non-arrivals, is offset in large measure by births, the school children having increased from 1,289 in 1900 to 2,596

in 1908. The Portuguese are increasing rapidly; the pupils of that nationality number 4,537. Hawaiians are slowly decreasing and part-Hawaiians increasing. The total number of Japanese men, women and children on the island of Oahu is probably 20,000, of whom perhaps 10,000 or 12,000 are adult males, although these are very rough estimates." * * *

"For some time there has been growing, even among sugar planters, a feeling that for the purpose of obtaining a permanent and certain supply of labor, as well as for the purpose of building up an American civilization in these islands, every effort possible should be made to encourage the immigration of people who will be or become American citizens. Since 1899 the number of non-Asiatic laborers on the sugar plantations has increased from 12 to 18 per cent. of the total, the increase in Asiatics having been 17 per cent. while that in non-Asiatics has been 87 per cent., the aggregate number on February 29, 1908, being 45,279, of whom 36,987 were Asiatics and 8,292 non-Asiatics.

"A little more than a year ago the Territorial Board of Immigration, at an expense of nearly $300,000, contributed by the planters, brought in 4,684 Portuguese and Spanish, consisting of 1,400 men, 1,143 women and 2,141 children, of whom 51 were returned, at an expense of $12,000. This was at an average expense of $62.20 per individual, or $207.32 per adult male. They were absolutely free to do as they wished upon arrival, but most of them engaged in service on the plantations, some settling on pieces of land that were furnished by the plantations and working for suitable wages, others working for higher wages without the land. But the general immigration act of 1907 precluded the further introduction of such people by means of contributions made by corporations. It is exceedingly desirable that Congress should authorize a continuation of such assistance with funds contributed, though by corporations.

"A considerable number of Portuguese and Spanish have been enticed from Hawaii to California, but have not found conditions there as favorable as represented. The Board of Immigration, by means of contributions from the planters, have assisted many of them to return, and last April established an office in Oakland, Cal., for the purpose of inducing and assisting such persons and others to return or come to Hawaii.

"The Board also has engaged a man, who has served under the Federal Bureau of Immigration and was recommended by the officials of that bureau, to come to Hawaii to acquaint himself fully with conditions here and then open an office in New York City for the purpose of obtaining Italians and others.

"Every known reasonable method is being exploited for substituting Anglo-Saxons and Latins for Orientals, but this is a difficult matter in the face of the present Federal immigration laws."

On the subjects of "Irrigation" and "Sugar Industry" the Governor states:

IRRIGATION.

General.—Hawaii being a tropical country, the question of water is of the utmost importance. There is no lack of rainfall, which ranges from a few inches to several hundred a year, according to locality, but the heavy fall is usually far from where it is most needed. The problem is that of conserving the water, by preventing it by means of forest growth from rushing to the sea down the short, steep watersheds, and that of transferring it to the arid lands. What is being done in forestry is stated under another heading.

The right to water usually depends on the ownership of the land upon which the water is, or on prescriptive use. Riparian rights, although recognized, are insignificant. Rights by prior appropriation have not been recognized.

The principal irrigated crops are cane, rice and taro.

Taro Lands.—Even in ancient times the natives had more or less elaborate systems of ditches in almost every valley for the irrigation of taro, their chief food, most of which was raised in water that was led from the streams into level patches which were made by terracing the bottoms and gentler slopes of the valleys. There were not only elaborate ditch systems, but also complicated methods of distribution of water by time and quantity, especially where or when water was scarce. The ditches were required to be kept clean and the patches tamped, so that the loss might be as little as possible. Much taro is still raised in this way. So important were the laws relating to water rights that they gave their name "kanawai" to laws in general.

Rice Lands.—Much taro land and additional dry land has been converted into rice land, which is laid out in small level patches the same way as taro land. In general rice requires more water than taro, for it requires running water, while taro may be grown in standing water if it is renewed at intervals, which vary according to locality. About 11,000 acres are in rice.

Cane Lands.—The chief irrigation works at present, however, are those of the sugar industry. Of the 213,000 acres devoted to sugar production, about one-half, or 105,000 acres, is irrigated, being practically reclaimed arid land, the reclamation of which has cost about $15,000,000, or about $140 per acre, in original outlay for the construction of ditch, tunnel, flume and pipe lines, reservoirs, steam and electric pumping plants, and artesian and surface wells. This has been done entirely by private enterprise. The irrigation system for one group of plantations includes about 225 miles of main and lateral ditches, tunnels, etc., which cost about $2,000,000, besides wells, reservoirs and pumping plants. Much of this is in country covered by dense jungle and cut up

by numerous deep canyons. The largest storage reservoir for one plantation holds 2,500,000,000 gallons. In one instance electric power is generated by water power on the rainy side of the island for the operation of pumps on the other side. One large ditch, completed during the last year, leads water from a valley on to high land, irrigates the high land below the ditch, then falls into another valley where it generates electric power for operating several pumps along the ditch for the irrigation of the high lands above it, and finally irrigates land on the plain below. About 1,000,000 gallons of water are required per day for each 100 acres of cane, irrigation being generally three or four times a month. In transferring water from taro land to cane land, it is generally estimated that the water appurtenant to 1 acre of taro land is sufficient for not less than 3 acres of cane land. About 4,350,000 tons of water are required daily for the irrigated cane land, about 60 per cent. of which is pumped by about 111 pumps with an aggregate capacity of 579,300,000 gallons per day of twenty-four hours. The average lift is 191 feet and the maximum 550 feet. Cane usually takes from fifteen to eighteen months to mature and 1 acre requires about 5,000,000 gallons per crop. The irrigated lands produce on an average nearly twice as much as the unirrigated.

Water Licenses.—Much of the water used for irrigating cane land is owned privately, but much also is obtained from government lands under licenses or leases. These licenses and leases have been made for periods of from fifteen to fifty years, most being of from twenty to thirty years. They are 15 in number and cover an aggregate area of 77,743.20 acres of forest and other land. The aggregate rentals are $16,601, besides 1 per cent. of the gross revenue in the case of the most important license. The rentals at first have been low because the licensees have had to construct the works, but as the leases and licenses expire they can be renewed for shorter periods at greatly increased rentals or the water can be used in other ways. One of these licenses, which was for thirty years at a nominal rental of $500 a year, has just expired, but the license provides for its renewal for another thirty years at the option of the licensee, the rental, however, to be fixed by appraisers each ten years. Steps have already been taken to obtain an appraisement for the first ten years. The Director of the Reclamation Service is expected soon to make an investigation with a view to ascertaining the practicability of extending that service to Hawaii.

Sugar Industry.—Hawaii is practically without mineral resources. The country is mainly agricultural, although the nature of the crops is such as to require much incidental manufacturing. Perhaps nowhere else has science been applied more extensively to agriculture, especially in the sugar industry, to which until recently attention has been devoted almost exclusively. A good beginning has now been made in other industries. It is impor-

tant both that there be a diversity of industries and that there be built up industries more suited to the small proprietor. The field is that of tropical agriculture. Among the agencies at work to perfect the science of that class of agriculture are the Federal Experiment Station, the Territorial Board of Agriculture and Forestry, the Territorial College of Agriculture and Mechanic Arts, and the experiment station of the Hawaiian Sugar Planters' Association. At times there has been lack of coöperation between some of these, but that state of affairs no longer exists. The first three of these are discussed elsewhere in this report. The planters' experiment station, although devoted principally to a single industry, is one of the largest and best to be found anywhere. It is maintained at a cost of $70,000 a year and has a large body of scientists in its several divisions, which include agriculture and chemistry, entomology and plant pathology. Agriculture is being made more and more of in the public schools. Further assistance is greatly needed through the scientific branches of the Federal Government, particularly in soil, topographic and hydrographic surveys, reclamation, branch experiment stations, etc., the appropriations for which objects should be made to apply to Hawaii, a full-fledged Territory and integral part of the United States, as well as to other parts of the United States.

Agricultural.—The sugar industry is conducted mainly by 49 corporations and 5 private companies or individuals. Many independent planters on a small scale raise cane and sell it to the corporations; and much land controlled by the corporations is cultivated by groups of laborers under contracts by which the plantations advance money, furnish implements, water for irrigation when necessary, and do portions of the work and purchase the cane at agreed prices, which vary with the price of sugar. The total capital, exclusive of bond issues, is $70,913,797. In the corporations there are 6,966 shareholders. The yield for the last five years has been as follows, in tons of 2,000 pounds:

AGRICULTURAL PRODUCTION OF HAWAII.

Island.	1903. Tons.	1904. Tons.	1905. Tons.	1506. Tons.	1907. Tons.	1908. Tons.
Hawaii	170,665	122,865	126,405	137,750	143,891	180,159
Maui	84,776	77,985	100,434	102,960	104,772	122,629
Oahu	121,066	102,019	123,095	113,750	119,273	137,013
Kauai	61,484	64,606	76,314	74,753	72,081	81,322
Total ...	437,991	367,475	426,248	429,213	440,017	521,123

The yield for the present year is 521,123 tons, valued at more than $40,000,000. The plantations are usually large. The total area cultivated is about 213,000 acres, held partly in fee and partly under lease, of which about one-half is irrigated. The yield per

acre per crop, which usually requires fifteen months or more to mature, is about 5¾ tons from irrigated and 3 tons from unirrigated land, or a little less than 4½ tons per acre from all the land. During the five years, 1902-1906, according to the returns of 49 companies, the average profit was 7.02 per cent. and the average dividend paid was 4.69 per cent. per annum on the capital invested. The continued success of this industry is largely dependent upon the continuance of a protective duty on sugar. The irrigation of cane lands is described under the heading "Irrigation" in this report. More than 41,000 tons of purchased mixed fertilizers are used annually, besides 6,000 tons of nitrate of soda and considerable quantities of lime, ground coral, tankage and waste products from mills and stables. The annual cost for fertilizers is over $2,000,000, and approximates $4.65 per ton of sugar, or $22.20 per acre per crop. On February 29, 1908, there were 45,279 laborers on the sugar plantations, as follows: Americans, 521; Europeans, mainly Portuguese and Spanish, 4,579; Hawaiians, 1,181; Porto Ricans, 1,837; Japanese, 31,805; Chinese, 2,991; Koreans, 2,191; others, 174; total Asiatics, 36,987; total non-Asiatics, 8,292. There has been a steady increase in the percentage of non-Asiatics—that in 1899 being about 12 per cent. and that at present about 18 per cent. The increase during that period has been only 17 per cent. in Asiatics, but 87 per cent. in non-Asiatics.

A HISTORY OF THE PROGRESS OF THE SUGAR INDUSTRY OF HAWAII SINCE THE RECIPROCITY TREATY OF 1876.

(Concluded from December, 1908, Number.)

Irrigation by Artesian Wells: The first artesian well was bored at Honouliuli in 1879 and was followed by a number of other wells in and around Honolulu.

In 1882 the editor of the Planters' Monthly issued a solemn warning against further borings. He stated, "It would appear that the sources of supply to the great subterranean reservoir have already been taxed to their utmost, or more than that, that the demand is already greater than the supply, and if artesian wells continue to be bored it will be but a few years before the wells at the higher levels will cease to give forth flowing water."

Notwithstanding this warning the development of artesian wells progressed very steadily, and in 1889 the borings on the Island of Oahu had reached the total of 103 wells.

At the present time the daily amount of water pumped from artesian wells on the Island of Oahu reaches about 300,000,000 gallons, some of it lifted upwards of 500 feet.

The artesian supply as found on Oahu does not appear to exist on any of the other islands of the group, and when pumping is resorted to, open wells or sumps are excavated, the underground supply resulting from rainfall on the mountain sides percolating through an upper broken stratum and retained by a lower stratum of inpervious rock.

These sumps are excavated to about 20 feet below sea level, tunnels are then driven on the lower stratum directly inland, opening up the water-bearing rocks, and the supply thus obtained is pumped from the sumps through very long pipe lines to the levels required on the cultivated areas.

To avoid the heavy expense of long pipe lines, there are three instances of shaft-sinking at the upper levels of the cultivated lands down to sea level, and regular underground pumps of mining pattern installed, but these have proved so expensive in first cost and up-keep that there is no encouragement to repeat the experiment.

One of the largest stations of this kind is at Kihei, on the Island of Maui, where the shaft is 300 feet deep and two pumping engines of a combined capacity of 17,000,000 gallons of water per day lifted 400 feet high, are situated in a very large chamber excavated in the rock; an abundant water supply is found at sea level, but the expenses of operation are very heavy in comparison to those of surface pumping stations delivering water through long pipe lines.

The machinery installed in the various pumping stations is of the most modern and complete make obtainable at the present day, and as in no other part of the world are such mechanical irrigating plants in existence, a more than passing notice may be of interest.

The plantations that pump all or part of their irrigation supply are situated as follows:

			Millions.
Island of Kauai..	3	approx. deliv. 24 hours in gallons.....	75
" " Oahu...	6	do	360
" " Maui...		do	150
" " Hawaii.	2	do	10
Total delivery per 24 hours, gallons, about.....			595

The average height to which this water is pumped is about 200 feet, and the total power developed to deliver this enormous quantity of water is over 20,000 horse-power.

The yearly expense of these pumping plants is enormous, but the figures of expense are not available.

Coal here costs from $7 to $9 per ton delivered at the furnace, although now a large number of pumping stations are operated with California crude oil as fuel, which is provided at a price about equal in value to coal at $6 per ton, and the economy in labor by using oil instead of coal is very marked.

In 1906 the cost of irrigation systems installed on 26 plantations was $14,069,804.

The relative yield of irrigated and unirrigated plantations since 1895 is as follows:

Year.	Acres.	Tons of Sugar.	Yield Per Acre—Lbs.
IRRIGATED PLANTATIONS.			
1895	23,454.5	89,943.5	7,669
1896	25,950	117,449	9,032
1897	23,101	117,306	10,151
1898	24,507	137,595	11,269
1899	27,380	166,425	12,157
1900	27,090.5	166,002	12,254
1901	34,740.5	215,190	12,388
1902	38,987	227,721	11,681
1903	42,097	260,525	12,377
1904	42,809.99	239,987.9	11,212
1905	48,668.12	295,797.99	12,156
1906	50,112.6	288,786.5	11,526
UNIRRIGATED PLANTATIONS.			
1895	23,945	63,476	5,310
1896	29,779	109,644	7,363
1897	30,724.5	133,820	8,710
1898	30,728.5	91,692.5	5,934
1899	32,928	116,382	7,068
1900	39,682.5	124,257	6,262
1901	43,878	143,943	6,561
1902	41,966	126,229.26	6,015
1903	51,253	177,529	6,927
1904	48,987.67	127,417.16	5,202
1905	46,775.39	131,567.69	5,625
1906	46,117	141,581.70	6,140

HAWAIIAN IMPORTS AND EXPORTS, AND SHIPPING.

On the following pages will be found a tabulated statement of the imports and exports of the Hawaiian Islands by years since 1875, showing (1) imports from the United States, (2) total imports, (3) exports of sugar, (4) exports of molasses, (5) total exports to the United States, (6) total exports to all countries, and (7) customs duties collected.

Also a statement showing the number, tonnage and nationality of vessels in the Hawaiian carrying trade for 1875, 1880, 1885, 1890, 1895, and for each succeeding year including 1908.

Also a statement showing the value of the carrying trade subdivided into nationality of the shipping, to and from Hawaii, for the years 1902-1908 both inclusive. Similar statistics for previous years are not available.

The table of imports and exports show a tremendous increase in the volume of Hawaiian trade since the Treaty of Reciprocity, and that the benefits from the expansion of the trade have very largely gone to the United States.

The total imports in 1876 were $1,811,770, of which $1,115,237 or 61 per cent., were from the United States.

The total imports in 1908 were $19,985,724, of which $15,503,-325 or 76.7 per cent. were from the United States.

In 1875, the year before the granting of the Reciprocity Treaty by the United States, the tonnage of American vessels engaged in the Hawaiian trade was exceeded by that of the British vessels, the percentage being, American 44.4 per cent., British 44.7 per cent.

At no time since reciprocity has the tonnage of vessels engaged in Hawaiian trade under the flag of a foreign nation nearly approached the tonnage under the American flag. The growth of American shipping in the Hawaiian trade has been very rapid, and is one of the most prominent features showing the value of the Islands and its trade to the mainland industries. One has but to glance at the table of exports and imports since 1875 to see that this growth has but kept pace with the growth of the sugar industry and that its maintenance is as dependent upon the prosperity of that industry, as the existence of the industry itself is dependent upon the continuance of the protection of the tariff.

The year before the Islands were annexed to the United States the tonnage of American vessels in the Hawaiian trade was 363,-168. In 1908 it is 747,181, the increase being due to the application of the coastwise laws.

NUMBER, TONNAGE AND NATIONALITY OF VESSELS IN CARRYING TRADE, 1875, 1880, 1885, 1890, 1895, AND EACH SUCCEEDING YEAR.

Nationality	1875		1880		1885		1890		1895		1896		1897		1898		1899		1900**		1901*		1902		1903		1904		1905		1906		1907		1908	
	No.	Tonnage	No.	Tonnage	No.	Tonnage	No.	Tonnage	No.	Tonnage	No.	Tonnage	No.	Tonnage	No.	Tonnage	No.	Tonnage	No.	Tonnage	No.	Tonnage	No.	Tonnage	No.	Tonnage	No.	Tonnage	No.	Tonnage	No.	Tonnage	No.	Tonnage	No.	Tonnage
American	74	41,350	179	99,614	184	131,011	224	153,098	219	183,876	247	243,983	286	270,045	331	272,138	447	363,168	310	292,771	119	170,801	475	629,639	426	673,418	377	677,350	406	800,485	363	791,410	296	695,372	303	747,181
Hawaiian	16	4,901	18	5,373	18	6,982	35	43,641	28	22,592	26	25,049	41	46,387	42	52,328	47	51,809	21	24,277	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....
British	35	44,425	26	31,201	30	38,749	16	22,91[illegible]	0	119,841	88	175,120	84	174,041	102	225,666	114	251,663	109	225,329	50	106,415	75	171,556	76	178,771	74	174,622	63	148,989	63	147,623	78	197,240	64	169,095
Chilian	..	.....	..	.....	..	.....	..	....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	1	1,332	..	.....	4	5,692	2	2,622	..	.....	..	.....	..	.....
French	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	1	589	4	7,626	..	4,186	2	3,151	5	10,233	8	22,201	8	28,178
German	3	1,286	3	2,130	5	2,377	9	7,070	9	10,805	8	9,705	4	4,788	6	8,189	6	10,598	9	10,695	6	6,970	7	11,165	6	7,218	6	8,680	6	8,501	5	9,673	3	6,531	3	6,045
Italian	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	1	1,626	3	4,150	2	2,943	2	3,146	1	1,135	..	.....
Japanese	..	.....	..	.....	..	.....	..	.....	..	.....	9	16,735	7	13,159	3	5,456	33	99,128	23	72,260	11	37,576	29	99,875	29	99,980	19	65,487	4	13,840	15	51,756	37	119,119	33	116,327
Norwegian	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	2	2,186	5	5,009	3	3,680	1	1,585	..	.....	5	8,238	3	4,527
Russian	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	1	1,468	..	.....	..	.....	..	.....	..	.....	1	1,098
Danish	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	1	2,674	..	.....	..	.....	..	.....	..	.....	..	.....
Swedish	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	2	3,157	..	.....	..	.....	..	.....	..	.....	..	.....
All others.....	4	1,148	13	3,590	4	3,817	9	9,980	2	1,703	8	7,405	5	5,406	7	5,855	8	10,476	12	17,578	8	8,026	..	.....	..	.....	..	.....	..	.....	..	.....	..	.....	1	2,588
Total	132	93,110	239	141,916	241	182,936	293	236,701	318	338,817	386	477,997	427	513,826	491	569,632	655	786,842	484	642,910	194	329,788	590	916,342	551	980,947	486	943,847	486	982,116	453	1,013,841	428	1,049,836	416	1,075,939

1908-1899. Number and tonnage entered.
1875-1899. Number employed.
* January 1 to September 30, not inclusive of vessels from American ports.
** Since June 14, 1900, not inclusive of vessels from American ports, covers period January 1, 1900, to December 31, 1900.

COMPARATIVE TABLE OF IMPORTS AND EXPORTS, 1875 - 1908.

Shows (1) imports from United States; (2) total imports; (3) exports of sugar; (4) exports of molasses; (5) total exports to United States; (6) total exports all countries; (7) customs duties collected.

Year.	(1) Imports from United States.	(2) Total Imports.	(3) Exports Sugar.	(4) Exports Molasses.	(5) Exports to United States.	(6) Total Exports All Countries.	(7) Customs Duties Collected.
1875.....	$ 947,260	$ 1,505,670	$ 1,216,388	$12,183		$ 1,774,083	$ 213,447
1876.....	1,115,237	1,811,770	1,272,334	19,510		2,241,041	199,036
1877.....	1,765,164	2,554,356	1,777,529	22,719		3,676,202	230,499
1878.....	2,053,726	3,946,370	2,701,731	12,107		3,548,472	284,426
1879.....	2,294,252	3,742,978	3,109,566	9,622		3,781,718	359,671
1880.....	2,671,823	3,673,268	4,322,711	29,753		4,968,444	402,181
1881.....	3,241,030	4,547,978	5,395,399	31,630		6,885,436	523,192
1882.....	3,559,032	4,974,510	6,320,890	33,293		8,299,019	505,390
1883.....	4,048,486	5,624,240	7,112,981	34,819		8,133,343	577,332
1884.....	2,835,127	4,637,514	7,328,896	16,579		8,856,610	551,736
1885.....	2,940,837	3,830,544	8,356,061	7,050		9,156,818	502,337
1886.....	3,724,995	4,877,738	9,775,132	14,501		10,565,885	580,444
1887.....	3,659,146	4,943,840	8,694,964	10,522		9,707,047	595,002
1888.....	3,353,660	4,540,887	10,818,883	5,900		17,707,598	546,142
1889.....	4,308,945	5,438,790	13,089,302	6,185		13,874,341	550,010
1890.....	5,264,691	6,962,201	12,159,585	7,603		13,142,829	695,956
1891.....	5,311,104	7,439,482	9,550,637	4,721		10,258,788	732,594
1892.....	3,850,499	4,028,295	7,276,549	5,061		8,060,087	494,385
1893.....	4,326,500	4,363,177	10,200,958	5,928		10,818,158	545,754
1894.....	4,154,790	5,104,481	8,473,009	6,050		9,140,794	522,855
1895.....	4,516,944	5,339,785	7,975,590	3,037	$ 8,392,189	8,474,138	547,149
1896.....	5,464,198	6,063,652	14,932,172	1,209	15,460,098	15,515,230	656,895
1897.....	6,800,028	7,682,628	15,390,422	2,892	15,689,030	[illegible]	[illegible]
1898.....	8,695,591	10,368,815	16,614,622	919	17,256,084		

COMPARATIVE TABLE OF IMPORTS AND EXPORTS, 1875 - 1908.—Concluded.

Year.	(1) Imports from United States.	(2) Total Imports.	(3) Exports Sugar.	(4) Exports Molasses.	(5) Exports to United States.	(6) Total Exports All Countries.	(7) Customs Duties Collected.
1899.....	15,020,830	16,069,576	21,898,190	358	22,517,758	22,628,741	1,295,628
1900.....	8,709,822	10,231,197	13,919,400	10	14,362,898	14,404,496	597,897
*1901.....	22,000,000	24,964,693	27,094,155	4,615	29,157,062	29,342,697	1,264,862
†1902.....	19,000,000	22,036,583	23,920,113	2,187	24,700,429	24,793,735	1,327,518
1903.....	10,943,061	13,982,485	25,310,684	1	26,201,175	26,275,438	1,193,677
1904.....	11,683,393	15,784,691	24,359,385	712	25,133,533	25,204,875	1,229,338
1905.....	11,753,180	14,718,483	35,112,127	1,282	36,112,055	36,174,526	1,043,340
1906.....	12,036,775	15,639,874	25,495,427	177	26,882,199	26,994,824	1,218,764
1907.....	14,435,725	18,662,434	27,692,997	355	29,071,813	29,303,695	1,458,843
1908.....	15,303,325	19,985,724	39,816,082		41,595,708	41,640,505	1,550,157

Total Customs duties collected 1901-1907 (both inclusive), $8,736,342.

* 12½ months to June 30, 1901—Imports from U. S. ports for 1901 estimated at $22,000,000, for 1902, $19,000.000.

† 5½ months to June 14. Imports from U. S. ports for 1901 estimated at $22,000,000, for 1902 $19,000,000.

VALUE OF CARRYING TRADE TO AND FROM HAWAII—1902 - 1908.

(Previous years not available.)

Nationality.	1902.	1903.	1904.	1905.	1906.	1907.	1908.
American	$25,896,884	$27,246,697	$26,597,353	$49,402,839	$41,987,370	$44,772,322	$58,883,202
British	1,076,003	1,126,610	1,490,338	676,848	779,987	1,332,700	1,127,126
French	.....	24,989	25,757	18,222	38,565	262,380	662,638
German	343,821	351,328	284,606	605,228	306,668	246,000	203,093
Italian	.....	.....	15,402	7,835	80,114	59,259	.....
Norwegian ...	4,981	86,789	15,173	29,105	.....	265,792	106,781
Japanese	.....	.....	.....	.....	.....	.....	.....
Others	508,629	591,038	573,887	152,932	247,627	802,757	1,241,339
Total	$27,830,318	$29,417,451	$29,002,516	$50,893,009	$43,440,331	$47,741,310	$62,224,179

During the period since annexation the total trade of the Islands has increased from $38,698,317. to $61,662,229, and of this trade American vessels now carry 94.6 per cent.

The following table of the value of the foreign trade of the United States carried in American vessels and Hawaii's percentage thereof, is interesting as showing that for the full years since the Organic Act took effect, under the coastwise navigation laws, Hawaii's trade in American vessels has averaged over 13 per cent. of the total foreign trade of the United States in American vessels:

	Value of Total Foreign Trade of the U. S. in American Vessels.	Value of Hawaii's Trade in American Vessels	Percentage that Hawaii's Trade in American Vessels Bears to Entire Foreign Trade of U. S in American Vessels.
1902	$185,819,987	$25,896,884	13.9 %
1903	214,695,032	27,246,697	12.6 %
1904	229,735,119	26,597,353	11.5 %
1905	290,607,946	49,402,839	17. %
1906	322,347,205	41,987,370	13. %
1907	318,331,026	44,772,322	14. %

Alaska, Porto Rico, Philippines, Tutuila, Guam and Hawaii are considered in United States trade statistics as non-contiguous territory of the United States. In the following table we show the details of the trade of the United States from 1903 and Hawaii's percentage thereof. It will be seen that taking the average of these years the trade of Hawaii has been more than one-third of the total of said countries. Considering the area and population of the non-contiguous territory the showing in favor of Hawaii is quite remarkable.

In passing, attention should be called to the Porto Rican trade and the increase thereof. In 1907 the trade of that island exceeded the trade of Hawaii by three million dollars, and the details of the trade show that the Porto Rican imports from the United States, during a number of years covered by the table, have exceeded in value the exports to the United States:

VALUE OF COMMERCE OF UNITED STATES WITH NON-CONTIGUOUS TERRITORY AND HAWAII'S PERCENTAGE OF TOTAL THEREOF.

	Alaska.	Porto Rico.	Philippines.	Tutuila.	Guam.	Hawaii.	Total.	Hawaii's Percentage.
1902	.....	$19,261,419	$11,726,986	.....	$ 15,603	$43,700,429	$ 74,704,437	...
1903	$19,738,270	23,297,040	17,807,157	$54,276	26,049	37,144,237	98,067,029	37.8
1904	20,330,250	22,932,886	15,735,991	57,025	155,593	36,816,926	96,028,671	38.4
1905	22,305,701	29,607,215	21,429,524	73,698	14,689	47,865,235	121,296,062	39.4
1906	24,142,164	38,367,342	15,913,304	77,069	12,392	39,031,599	117,543,830	33.2
1907	30,557,963	47,756,418	17,234,563	58,057	17,552	43,507,538	139,132,091	31.3

The value of the exports of domestic produce and manufactures from the United States into Hawaii in proportion to the total of all imports into Hawaii, compares very favorably with the Cuban trade with the United States, and I have been able to obtain figures of Cuban trade for the years 1903, 1904, 1905 and 1906. They show that the imports of merchandise from the United States have never in said period reached more than 48.6% of the total imports. On the other hand, the exports from Cuba to the United States have gone as high as 86.53% of the total of all exports.

In Hawaii's case, the percentage of imports from the United States has never during said period gone lower than 74.3%, and as high as 79.9%. That the percentage of imports from the United States is not greater is due to the large Asiatic population of these Islands, and the fact that this population imports large quantities of merchandise of all descriptions from the Orient.

COMPARISON OF TRADE OF UNITED STATES WITH CUBA AND HAWAII.

1903, 1904, 1905, and 1906.

CUBA.

Year.	Imports of Merchandise.	Imports from United States.	Per cent. Imports from U. S.	Exports of Merchandise.	Exports to United States.	Per cent. Exports to United States.
1903	$58,826,000	$21,769,572	37.	$ 77,849,000	$62,341,942	80.
1904	77,028,000	32,644,345	42.3	89,013,000	74,950,992	84.2
1905	94,807,000	42,982,000	45.34	110,168,000	95,331,000	86.53
1906	98,020,000	47,602,000	48.6	103,914,000	88,175,000	84.8

HAWAII.

1903	13,982,485	10,943,061	78.3	26,275,438	26,201,175	99.8
1904	15,784,691	11,683,393	74.3	25,204,875	25,133,533	99.7
1905	14,718,483	11,753,180	79.9	36,174,526	36,112,055	99.8
1906	15,639,874	12,036,775	76.9	26,994,824	26,882,199	99.5

* Reciprocity Treaty with Cuba went into effect December 27, 1903.

	Exports from U. S. to Cuba	Imports Into U. S. from Cuba
1900	$26,513,400	$31,371,704
1901	25,964,801	43,423,088
1902	26,623,500	34,674,684
1903	21,761,638	62,942,790
1904	27,377,465	76,983,418
1905	38,380,601	86,304,259
1906	47,763,688	84,979,821
1907	49,305,274	97,441,690

Not only have the American industries profited by the expansion of the Hawaiian sugar production, and the consequent increase in trade, but since annexation the Territory has collected in customs duties and internal revenue, and paid toward the national expenditure, $9,192,021, made up as follows:

Customs duties collected	$8,736,342
Internal revenue collections	455,679
	$9,192,021

In 1907 the customs duties collected in this Territory amounted to $1,485,843, or a per capita collection on a population estimated at 200,000, of $7.43. For the same year the duty collected on merchandise imported into the United States per capita was $3.84. This would seem to indicate that the people of this Territory are certainly bearing their burden of the general expenses of the National Government.

In 1907 Hawaii stood twelfth of the customs districts of the United States in the amount of duties collected, as shown in the following table:

1.	New York	$217,127,610
2.	Boston	27,627,759
3.	Philadelphia	20,779,574
4.	Chicago	10,188,176
5.	San Francisco	9,877,699
6.	New Orleans	7,996,358
7.	Baltimore	5,019,610
8.	St. Louis	2,434,420
9.	Detroit	2,036,441
10.	Tampa	1,701,592
11.	Puget Sound	1,614,560
12.	Hawaii	1,458,843

Hawaii has collected more than such large customs districts as Cincinnati, Cleveland, Newport News, Providence, Galveston, Seattle, Milwaukee.

For much of the information contained herein the writer is indebted to Custom House officials, Thrum's Annual, early numbers of the Planters' Monthly and to Mr. L. A. Thurston's article published in the Pacific Commercial Advertiser. R. D. M.

*REPORT OF COMMITTEE ON CULTIVATION AND IRRIGATION ON IRRIGATED PLANTATIONS FOR ANNUAL MEETING H. S. P. A.—NOV. 9TH, 1908.**

Puunene, Maui, T. H., Nov. 5th, 1908.

To the President and Members of the Hawaiian Sugar Planters' Association:

I do not think I can bring before you, for your consideration, any important changes in the methods of cultivation and irrigation of cane, since the last annual meeting.

The general methods of preparing the land, and of cultivation and irrigation, are pretty well established, although changes are often made to advantage from time to time in the details of cultivation. The planters are constantly alive to any change in method of cultivation, that may be an improvement, or, in the line of economy.

There is much more opportunity for adopting new implements, such as disc plows, cultivators, etc., on unirrigated than on irrigated plantations, as the use of small plows and cultivators on irrigated lands break up the little ditches, and the whole system of irrigation in the fields, and are consequently not so much used on irrigated lands. However, cultivating implements can be, and are used to great advantage on irrigated plantations in clearing up rattoons, and keeping the land mellow before the rattoons are fairly taken under cultivation and regular irrigation.

On our irrigated plantations on Maui our land is thoroughly plowed and prepared for planting with steam plows. The milling season begins with us about the 1st day of December, and generally lasts until about July 1st the next year. In order to make use of the tops for planting, which we consider the best seed we can use, we commence planting the latter part of March, and plant with tops more than half of the fields we plant each year. When necessary, on account of root disease, or insect pests, all the seed is put into tanks containing Bordeaux Mixture, and left there about two or three hours before planting. All fields planted before the first day of July, are cut-back as soon after July 1st as possible, as this young cane is quite likely to tassel in the Fall. The rattoons from the young cane thus cut back start up at once strong and vigorous. Fields that are planted as above, at high elevations, or in localities where cane is not likely to tassel, are cut back in June.

We usually cultivate one crop of rattoons to each crop of plant cane on our uplands, and at least two crops rattoons on our low lying lands, where the soil is rich.

* Publication of this report was delayed owing to the lack of certain tables at the time it was presented.—Ed.

We take the rattoons under cultivation as soon after the 1st of July as possible, cutting-back the growth made after the plant cane was milled, if milled before June 1st. We hill-up all the rattoons on our plantation at Puunene and Maui Agricultural Co. The soil is first loosened up thoroughly between the rows by 3-pronged cultivators, which stir up the soil to a depth of 12 or 15 inches. Then a small furrowing plow is run between the rows, followed by a larger furrowing plow, that we call a hilling-up plow. The soil is thus thoroughly pulverized and thrown up around the cane. We get a better result from our rattoons if the hilling-up is done before the cane is cut back. We figure roughly that rattoons properly hilled-up, yield one or two tons of sugar per acre more, than rattoons not hilled-up.

On the subject of irrigation I would simply say that we have found on the very dry lands at Puunene, that it takes on the average from 10 to 12 inches of water each month, over the whole surface of the fields, to keep the cane properly irrigated. On plantations like the Hamakuapoko Plantation, where they have more rain than we do at Puunene, they require less water.

On plantations that depend upon rain for watering their fields, 7 inches of rain a month waters the cane as thoroughly, and keeps up as vigorous a growth as 10 or 12 inches of irrigation water run over the whole surface each month.

The Maui Agricultural Company have lately installed, on the sand beach at Paia, a lime kiln, where there is an immense quantity of coral sand. This kiln turns out about 200 barrels a day of excellent lime made from sand at a low cost.

A large portion of the soils on the slope of Haleakala are low in lime, and we are now putting on our lands that require lime, from 500 to 1,000 pounds to the acre, according to the needs of the soil. Young cane, both plant and rattoons, started this year, on fields treated with this lime, are growing fine and vigorously.

I herewith give the analysis, made at the experiment station, of the lime made in this kiln from coral sand:

EXPERIMENT STATION OF THE HAWAIIAN SUGAR PLANTERS' ASSOCIATION, DIVISION OF AGRICULTURE AND CHEMISTRY.

Honolulu, August 21st, 1908.

Laboratory No. 1506.

Analysis of Lime from Maui Agricultural Co.

Moisture, combined	15.77%	.....%
Insoluble residue	.21	.30
Iron and aluminum oxides	.84	1.23
Lime	63.78	91.36
Magnesia	4.09	5.83
Carbonic acid	14.42	.....
Sulphuric acid	1.01	1.44
	100.12	100.18

(Sgd.) NOEL DEERR, *Director.*

It often happens during the summer on plantations dependent on irrigation, that our mountain streams run low, especially in the Fall. It is an unfortunate time to be short of water, as at that time we have two crops in our fields requiring irrigation, the large cane nearly ready for the mill, and the young crop, to be milled the year following. It becomes a question at such times, when there is not sufficient water to irrigate both crops, which crop to rob of water, the old cane or the young. At such times a manager's judgment and knowledge of cultivation are severely taxed, for mistakes in the distribution and handling the water, when there is not sufficient to irrigate all the cane properly, may materially affect the outturn of his crops.

I notice that this question was brought up for discussion at an annual meeting of the Planters' Association three or four years ago by C. M. Cooke. I was not present at that meeting. Different planters at that time expressed their views on this subject, some in favor of robbing the young cane, if necessary, in order to keep up the growth of the old cane. Others took the ground that the young cane should be irrigated properly, even if this was done at the expense of the old cane.

My opinion is that when the water is short in the Fall of the year, and there is not sufficient to irrigate both large and small cane, the small cane should be robbed to a certain extent, in order to keep up the growth of the old cane, if possible. During the period from say July to and including November, cane will, if it receives sufficient water and proper cultivation, make about twice the growth that it will at any other time during its existence. The tasselling season is November, and it is natural that cane should make its best growth as the tasselling season approaches. Moreover, the cane is large and the ground is full of roots, and at that time naturally needs more water than at any other time during its existence, whereas young cane, which would at the tasselling time be only three to five months old, can get along with very little water, if handled with judgment. Cane three to five months old requires only about one-half the water that cane from 15 to 17 months old requires, which would be the age of the large cane at the tasselling time, and do well with less than half the amount required by the large cane.

I give herewith figures showing the growth of large cane in different fields at Puunene in the latter part of the year, and also at Hawaiian Sugar Company plantation. I would also say that cane not only grows rapidly near the tasselling time, but it increases in diameter. These tests really should have been made for a full year, to show plainly the difference between the growth of young and old cane:

TABLE SHOWING GROWTH OF LARGE CANE THE LATTER PART OF THE YEAR, HAWAIIAN COMMERCIAL & SUGAR CO.

Month	Joints	Inches	Field	Kind of Cane
June	5	9	"B"	Plant
July	7	13½	"	"
August	7	11½	"	"
September	8	22½	"	"
October	7	26	"	"

Month	Joints	Inches	Field	Kind of Cane
June	5	12	"B"	Rattoon
July	7	14½	"	"
August	6	13	"	"
September	8	18½	"	"
October	6	20	"	"

TABLE SHOWING GROWTH OF LARGE CANE THE LATTER PART OF THE YEAR, HAWAIIAN SUGAR COMPANY—CROP 1909.

Month	Inches	Field	Kind of Cane
June	9	Camp II	Plant
July	8	"	"
August	10	"	"
September	12	"	"
June	10	"E"	"
July	11	"	"
August	13	"	"
September	17	"	"

Month	Inches	Field	Kind of Cane
June	11	Yellow Ridge	Rattoon
July	14	"	"
August	15	"	"
September	17	"	"
June	8	Camp II	"
July	9	"	"
August	15	"	"
September	14	"	"

Dr. Maxwell, when superintendent of the Planters' Experiment Station, advanced the theory that the application of fertilizer on large cane, say two or three months before the tasselling time, would have the effect of starting such a growth that the cane would not tassel. His theory being, as I understood it, that very rapid growing cane was not near as likely to tassel as slower growing cane. He advocated the use of fertilizers to prevent tasselling, if, on account of the cane being too young, or, not of

sufficient size to be allowed to tassel, the planter desired to check the tasselling. He did not state that fertilizers would *always* prevent tasselling, but that it would *often* do so.

Now I have for a good many years studied the question of cane tasselling, and the causes that operate to affect the tasselling of cane. In connection with this question I have made a good many experiments. Dr. Maxwell is undoubtedly correct, to a certain extent, in his theory. Fruit trees and shrubs are not likely to fruit well, if they grow vigorously during the fruiting season. I would say, however, that I have always found that the main factors or elements that affect the tasselling of cane are water, temperature and air. If the cane has sufficient water, warmth and air, in other words the elements that produce healthy cane, it will tassel quite generally, but if the cane lacks the proper amount of one or more of these elements, the tasselling will not be so general. If the cane has not had sufficient water, this will check tasselling, or if the growth of cane is very heavy, and lies so thick on the ground that the circulation of air through it is poor, tasselling will not be general, or if the cane is at a high elevation, or the air is for some reason cold, this will check tasselling.

Fertilizers may produce such a heavy rapid growth of cane that the circulation of air through it is poor. In that case the fertilizer affects the tasselling of cane, but it is not so much, according to my observation, because the fertilizer produces a vigorous growth, as it is because the heavy growth, produced by the fertilizer, prevented sufficient circulation of air, and the lack of air checks tasselling. The usual time for cane to tassel on Maui, is from October 15th to November 1st.

There are three different temperature conditions, I have observed, that affect the tasselling of cane, so that tasselling comes on quite early and is general.

1st. A high average, both maximum and minimum temperature, and a fairly uniform temperature. This, I consider, the most perfect temperature condition for early and general tasselling, but this condition does not often exist here. The cold breezes from the top of Haleakala, and the much warmer breezes from the sea, and also the trade winds, so disturb our atmospheric conditions, that it is seldom we have a uniform temperature for any length of time.

2nd. I have found that the tasselling of cane begins quite early in the season, and is quite general, even if the minimum temperature is rather low, say 65 or 70°, *provided* the average maximum temperature runs very high.

3rd. I have also found that tasselling begins early, and is general, even if the average maximum temperature is not very high during the tasselling season, *provided* there is not a great difference between the maximum and minimum temperature, and both high and low temperature are fairly uniform.

I herewith give diagrams and figures to show how temperature on our plantations here affects the question of tasselling:

The first signs of tasselling in 1907 commenced as follows on the different plantations, and in the different camps, represented by the diagrams herewith attached:

At Camp VII, Puunene, tasselling commenced September 7th, 1907. This is unusually early. It will be observed that the average maximum temperature was 90.93°, and the minimum temperature 69.64°, and the difference 21.39°.

The temperature report showed high temperature, especially about the tasselling time. This illustrates very well the tasselling of cane under the second temperature condition mentioned above.

At Camps I and V, Puunene, tasselling commenced October 8th. The temperature report was lower at these two Camps, as per diagram, than at Camp VII.

On the Paia and Hamakuapoko plantations tasselling commenced soon after October 1st, 1907, at Paia, and October 1st at Hamakuapoko. It will be observed that the average maximum temperature at Hamakuapoko was 77.74°, and the average minimum temperature 68.86°, the difference being only 10.88°, and the temperature fairly uniform. The tasselling was early, though not as early as at Camp VII. This illustrates very well the tasselling of cane under the third temperature condition mentioned above.

It is an important matter that we understand the question of tasselling thoroughly, as we can control it to a great extent by regulating the irrigation of the cane, the circulation of air, and the time of planting.

I think it would be a good plan for the Experiment Station to take up this tasselling question, and investigate it fully.

Some of the planters are burning cane that is being cut for the mill, in small sections, enough for two days' milling at a time. The object being to destroy borers and borer eggs, also, other pests that the cane may be afflicted with, and also to reduce the cost of cutting. When the cane is not left in the field too long, but is milled in two or three days after it is cut, according to our experiments, no harm is done, and the sugar from cane just burnt is just as good in appearance, and according to analyses, than if the cane had not been burnt. At times I have noticed that some of the cane burnt and cut for the mill, has stood for four or five days, before it was milled. I have therefore made careful tests with the cane that was burnt, and cane from the same field that was not burnt, but cut at the same time the burnt cane was burnt and cut. These tests I append herewith:

TABLE OF TESTS BURNT AND NOT BURNT CANE, HAWAIIAN COMMERCIAL & SUGAR CO.

Puunene Mill, July 3rd, 1908.

The following tests were made to determine the keeping qualities of the cane, it being thought by some, that the burning of cane caused no ill effects as to sucrose content up to five days after it was burnt. It is evident that none of the solids will be lost in the drying of the cane, hence if there is no destruction of sucrose, the quotient of purity should remain about constant. Furthermore, if acid is formed, it will at once attack the sucrose and convert it into glucose, and the percentage of acidity would remain about the same. There are thus two figures which indicate the keeping qualities of cane, namely: Quotient of purity and per cent. glucose. Unfortunately, the glucose was not determined until the last day of the test, but this shows such a marked difference, that, coupled with the much lower and faster decreasing quotient of purity, there can be no doubt that the burnt cane does deteriorate faster than that not burnt:

CANE BURNT.

	Brix	Suc.	Pur.	Acidity
June 22	22.6	20.75	91.8	0.049
June 23	24.4	22.35	91.6	0.049
June 24	22.7	20.60	90.7	0.053
June 25	25.0	22.85	91.4	0.038
June 26	25.1	22.55	89.8	0.039
June 27	26.1	23.80	91.3	0.046
June 29	25.3	19.60	77.5	0.070
June 30	28.9	21.65	75.0	0.080
July 1	29.4	19.91	66.2	0.073
July 2	30.3	18.90	62.4	0.070
Average	25.98	21.30	81.99	0.057

CANE NOT BURNT.

	Brix	Suc.	Pur.	Acidity
June 22	21.8	20.00	91.8	0.049
June 23	20.0	17.03	85.2	0.050
June 24	22.7	21.60	94.3	0.036
June 25	23.4	21.55	92.2	0.038
June 26	24.6	22.65	92.2	0.052
June 27	23.0	19.91	86.5	0.050
June 29	28.1	23.02	82.0	0.050
June 30	24.7	21.35	86.3	0.038
July 1	24.2	19.61	81.2	0.042
July 2	26.7	21.42	80.3	0.049
Average	23.92	20.81	87.00	0.045

Per cent. Glucose in burnt cane..... 7.69
Per cent. Glucose in cane not burnt..... 3.25
Per cent. Glucose in fresh cane..... 0.58

(Sgd.) H. E. SAVAGE,

Chemist.

Twelve sticks each of burnt and cane not burnt were brought to the laboratory on July 10th, and an aliquot part of each stick was analyzed each day for 15 days for Brix, Sucrose, Purity, Acidity, Glucose, Percent. of Juice extracted on the weight of cane, and Percent. of Sucrose extracted on the weight of cane. Each sample was subjected to the same pressure so the per cent. of juice extracted and per cent. of sucrose extracted are comparable from day to day:

BURNT CANE.

Date	Brix	Suc.	Purity	Acidity	Glucose	% Juice extracted on wt. of cane	%Suc. extracted on wt. of cane
July 10	22.6	20.42	90.4	0.045	0.388	50.9	10.40
July 11	22.5	20.22	89.9	0.043	0.521	54.3	10.99
July 12	25.2	22.07	87.5	0.049	0.92	53.8	11.90
July 14	24.2	21.60	89.3	0.049	0.90	49.1	10.60
July 15	25.4	22.10	87.0	0.049	0.72	48.3	10.68
July 16	26.4	19.50	73.9	0.049	1.83	47.5	9.26
July 17	26.2	22.00	84.0	0.049	1.96	50.0	9.80
July 18	27.3	23.20	85.0	0.056	1.85	47.5	11.02
July 20	29.7	24.30	81.8	0.063	2.50	45.5	11.05
July 21	29.8	23.50	78.8	0.063	3.12	43.4	10.20
July 22	30.5	23.30	76.4	0.059	3.88	40.4	9.41
July 23	32.8	22.40	67.3	0.066	4.81	38.2	8.55
July 24	33.0	22.10	67.0	0.070	5.75	41.4	9.15
July 25	32.4	19.30	59.6	0.063	8.00	40.0	7.72
July 27	32.6	18.00	55.2	0.099	9.80	36.8	6.62
Average	28.00	21.60	77.14	0.059	3.13	45.81	9.82

CANE NOT BURNT.

Date	Brix	Suc.	Purity	Acidity	Glucose	% Juice extracted on wt. of cane	% Suc. extracted on wt. of cane
July 10	20.5	18.50	90.2	0.052	0.149	51.8	9.58
July 11	21.9	19.70	89.9	0.048	0.138	53.9	10.62
July 13	23.7	19.82	83.8	0.056	1.44	55.6	11.02
July 14	23.7	18.70	78.8	0.052	2.45	56.7	10.60
July 15	24.1	17.90	74.3	0.045	2.22	57.9	10.36
July 16	24.4	17.74	72.7	0.042	3.91	58.1	10.31
July 17	24.3	16.99	69.8	0.042	4.42	59.7	10.14
July 18	24.4	16.67	68.3	0.042	4.13	59.4	9.90
July 20	25.1	16.73	66.7	0.049	5.55	59.7	10.00
July 21	25.5	16.78	66.8	0.049	5.65	60.3	10.11
July 22	24.9	17.04	68.4	0.049	6.90	62.9	10.73
July 23	25.5	17.09	67.0	0.045	6.17	56.9	9.72
July 24	25.5	16.40	64.4	0.042	6.45	54.8	9.00
July 25	25.2	16.80	66.7	0.042	7.14	53.4	8.80
July 27	25.9	16.30	62.9	0.052	7.69	58.3	9.50
Average	24.28	17.55	72.28	0.047	4.29	57.29	10.03

(Sgd.) H. E. SAVAGE,
Chemist.

TABLE OF TESTS BURNT AND NOT BURNT CANE, KAHUKU PLANTATION CO.

Kahuku, Oahu, October 5th, 1908.

After making some experiments with cane harvested during the past month, more particularly as regards condition of burnt cane compared with cane not burnt, after keeping same for 10 days, we beg to report as follows:

We found after the end of the 5th day, that one kind had kept as well as the other, and we herewith quote you analyses of samples of burnt and cane not burnt from the 6th to the 10th days, both inclusive:

	CANE BURNT			CANE NOT BURNT		
	Brix	% Sucrose	Purity	Brix	% Sucrose	Purity
6th day	17.0	12.60	74.1	20.4	17.0	83.3
7th day	19.4	14.8	76.3	20.2	16.35	80.9
8th day	20.4	15.0	73.5	20.0	16.6	83.0
9th day	19.4	13.4	69.1	21.1	17.0	80.6
10th day	24.9	16.86	70.3	23.1	18.65	80.7

In regard to paragraph 3 of your letter dwelling on the effect of temperature on the tasselling of cane, Mr. Adams states that he had found that warm weather conditions here brought on tasselling quicker than during cool weather, which we note has been your experience both at Puunene and Maui Agricultural Co.

Referring to paragraph 4 in the matter of when to apply most water to cane, Mr. Adams states that he fully agrees with your claim that cane needs more water on toward tasselling than at any other stage of its growth, and also that in case of a shortage of water it is better to economize on the young cane than on that of a larger growth.

KAHUKU PLANTATION COMPANY,

(Sgd.) Per G. G. Kinney.

TABLE OF TESTS BURNT AND NOT BURNT CANE, HAWAIIAN SUGAR COMPANY.

CANE BURNT.

1908	% Loss by Fire & Air	Expression %	Brix	Sucr.	Purity	Sucrose Gain or Loss %	Purity Gain or Loss %
July 24...	1.6	67.0	22.22	21.23	95.5	— 1.8	+ 1.6
July 25...	?	68.7	24.63	23.91	97.1	+10.6	+ 3.3
July 26...	4.7	50.2	23.34	21.74	93.1	+ 0.6	— 0.9
July 27...	7.5	61.9	23.27	20.78	88.4	— 3.8	6.0
July 28...	6.0	62.8	24.54	22.57	91.9	+ 4.4	2.2
July 29...	12.6	64.6	25.60	23.05	90.0	+ 6.6	4.3
July 30...	15.5	?	27.32	24.03	88.0	+11.2	6.4
July 31...	17.9	56.4	23.71	20.07	84.6	— 7.1	10.0
Aug. 1...	19.4	58.6	26.33	22.42	85.2	+ 3.7	9.1
Aug. 2...	16.8	53.8	21.72	17.42	80.2	—19.4	14.7
Aug. 3...	20.7	57.3	25.70	22.25	86.6	+ 3.0	7.9
Aug. 4...	23.5	52.4	24.52	18.94	77.2	—12.4	17.9
Aug. 5...	24.8	50.8	24.77	18.02	72.8	—16.6	22.6
Aug. 6...	27.8	44.1	29.14	22.95	78.1	+ 6.2	16.9
Aug. 7...	27.3	46.3	27.13	19.98	73.4	— 7.5	21.9
Aug. 8...	45.2	52.9	27.83	19.92	71.6	— 7.8	23.8
Aug. 9...	33.2	50.1	26.39	13.10	49.6	—39.4	47.2
Aug. 10..	32.5	40.3	28.15	20.98	74.6	— 2.9	20.6
Average..	19.8	55.2	25.34	20.74	81.6	— 4.0	—12.6

CANE NOT BURNT.

1908	% Loss in the Air	Expression %	Brix	Sucr.	Purity	Sucrose Gain or Loss %	Purity Gain or Loss %
July 24...	Nil	70.5	22.98	21.61	94.0	....	....
July 25...	2.6	67.4	24.11	23.24	96.4	+10.8	+ 2.6
July 26...	?	63.3	23.78	21.68	91.2	+ 0.3	— 3.0
July 27...	5.0	68.4	22.37	19.86	88.8	—12.7	— 5.5
July 28...	6.4	60.6	23.04	20.55	89.2	— 4.9	— 5.1
July 29...	8.4	65.5	24.24	23.30	96.1	+ 7.8	+ 2.2
July 30...	8.6	?	24.98	21.98	88.0	+ 1.7	— 6.4
July 31...	9.3	61.8	23.19	18.44	79.5	—14.7	15.4
Aug. 1...	15.3	60.6	25.13	20.88	83.1	3.4	11.6
Aug. 2...	6.9	61.6	24.74	19.12	79.8	11.5	15.1
Aug. 3...	?	59.8	26.07	20.99	80.5	2.9	14.5
Aug. 4...	16.5	57.1	23.01	14.88	64.7	31.1	31.2
Aug. 5...	18.1	64.6	22.88	15.83	69.2	26.7	26.4
Aug. 6...	23.3	56.5	21.26	13.57	63.8	37.3	32.1
Aug. 7...	21.8	53.7	21.18	?	?	?	?
Aug. 8...	20.4	57.0	25.20	5.20	20.6	75.9	78.1
Aug. 9...	23.5	54.6	23.72	9.00	37.9	58.4	59.7
Aug. 10..	23.6	49.2	24.86	12.69	51.0	41.3	45.7
Average..	13.1	60.7	23.86	17.81	74.7	—18.8	—21.6

CANE BURNT—SECOND TEST.

On this occasion the burning of the canes had been very slight, and was very irregular. The canes sent to the laboratory for being tested there, were not of equal quality, there being canes with long, medium and very short joints.

Although the canes at this occasion were only burnt very slightly, and were of varied quality, it can nevertheless be seen that the burnt canes kept longer, in better state as regards sucrose content, the juice purity, etc., than the original cane that was not burnt.

The weather had been dry and warm for nearly the whole of the period that cane, burnt and not burnt, had been exposed to the air under free sky.

August 18th, 1908.

(Sgd.) C. J. L. SCHMIDT,

Chemist.

The planters had quite a discussion at the last Planters' meeting on the question of stripping cane.

This discussion led me to have tests made in our laboratory at Puunene of juice from stripped and unstripped cane. We selected a large field of heavy plant cane to take our samples from, that had not been stripped, excepting in a few places.

We tested samples of both stripped and unstripped cane each month from January 1st, 1908, to June 30th, when the milling of this field was finished, taking great pains to select all the samples from cane growing under similar conditions, with the sticks about the same in length and the same in diameter, and the joints the same in length. The juice from both the stripped and unstripped cane analyzed about the same when the first test was made, January 1st, 1908. This test was made so early in the season that we looked for an improvement in the juice later on. Tests were made each month for six months, as stated above, which demonstrated fully that unstripped cane improved much more steadily in quality than the stripped cane. We found that the temperature of the soil in the unstripped cane was warmer than in the stripped cane, and I feel sure that the juice from the unstripped cane was also warmer than the juice from the stripped cane, but the Chemist did not test the juices for temperature. I am inclined to think that the temperature of the cane is a factor that should be considered in these tests, for I fully believe that unstripped cane has a more uniform temperature than stripped cane and that this would account, in part, for the juice from unstripped cane being higher in sucrose than stripped cane.

I append herewith a copy of the tests above referred to:

HAWAIIAN COMMERCIAL & SUGAR CO.—COMPARISON OF STRIPPED AND UNSTRIPPED CANE; FIELD "G", RATTOONS.

	Stripped			Unstripped		
Date	Brix	Sucrose	Purity	Brix	Sucrose	Purity
January	18.1	16.80	92.8	19.9	19.08	95.8
	19.9	18.77	94.2	19.8	18.37	92.8
	19.2	18.25	95.1	19.2	18 15	94.5
	19.4	18.21	94.0	19.2	18.31	95.4
Average for Jan.	19.15	18.01	94.05	19.52	18.48	94.67
February	19.1	17.08	89.4	18.09	17.08	90.3
	20.3	18.34	90.3	18.6	16.55	89.0
	20.6	19.00	92.3	19.3	18.02	91.1
	20.3	18.75	92.3	20.4	19.05	93.0
	20.9	19.10	91.4	21.3	19.34	90.3
	20.8	19.02	91.5	20.4	18.67	91.5
Average for Feb.	20.33	18.55	91.24	19.67	18.12	92.12

March 19.8	17.78	89.8	21.2	19.99	93.4
.....20.7	18.74	90.6	19.9	17.80	89.4
.....20.3	18.20	89.6	20.6	18.80	20.3
Average for Mch..20.27	18.24	89.99	20.57	18.80	91.40
April 20.3	17.57	86.5	21.9	20.51	93.5
.....22.0	18.99	86.3	22.6	20.60	91.2
.....20.0	17.81	88.6	22.5	20.90	92.9
Average for Apr..20.77	18.12	87.24	22.33	20.67	92.57
April 30th.....20.0	17.86	89.3	19.4	18.33	94.5
Grand Average ...20.10	18.25	90.80	20.31	18.78	92.47
Average Temp. of Soil....67.86				68.15	

(Sgd.) H. E. SAVAGE,
Chemist.

Puunene, Maui, November 11th, 1908.

H. P. BALDWIN,
GEO. F. RENTON,
H. A. BALDWIN.

THE POSSIBILITIES OF CANE SUGAR IN THE PACIFIC OCEAN ISLANDS.

BY H. C. PRINSEN GEERLIGS.

Now in these latter years, when the attention of the whole sugar world is fixed upon Cuba and a probable shortage or surplus of the crop of that island is sufficient to cause considerable fluctuation in prices, it is well to point out how possibly changes in the conditions of other islands may cause still larger and more continuous disturbances of the sugar market.

Everybody knows how under the impulse of capital and fostered by scientific research and appliance of the results thereof, the sugar industries of Java and of Hawaii have increased their output in a very short time to an enormous extent. The cane sugar production of Java which amounted in 1897 to 564,000 metric tons, had already more than doubled in 1907, or ten years later, when it amounted to 1,210,000 tons, and this not by leaps and bounds, with short crops between them, but gradually advancing. In fact, the sugar industry in Java is at the present time conducted on such firm and scientific bases that though, of course, the crop may be better or worse in some certain year, yet no failure of an entire crop can possibly be expected. All the conditions of the cane and its cultivation are so well studied, that even the

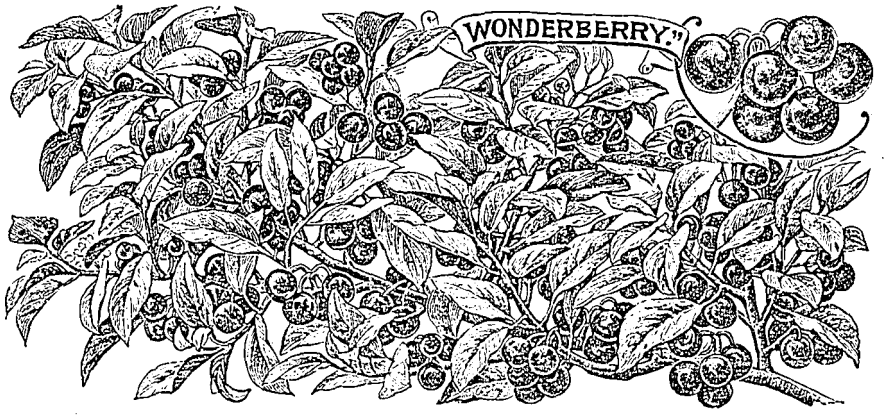
outbreak of a cane disease or the attacks of some new insect pest can be remedied against before they can do any harm. The same thing may be said of Hawaii. Some fifty years ago the sugar industry could only supply the sugar necessary for the local consumption and now the islands export as much as 400,000 short tons or thrice the quantity exported 10 years ago. There too the planters have based their methods on a scientific footing and preferred to investigate everything and to leave as little as possible to good or bad luck. This is distinctly proved by the happy results of the campaign against the leaf-hoppers that infested the Hawaiian sugar fields a couple of years ago. In former times such an invasion of an uncontrollable mass of offensive insects would have found the planters unprepared and would have been able to do an enormous amount of harm. Now the scientists did not hesitate to apply the remedy, which they knew would help them and brought to their aid the natural enemies of their foes, with the happy result that the damage done by the hoppers was checked at once and the sugar crop continues to be larger every year.

It is evident that such a state of things is not only confined to the islands mentioned, but that also other islands in the same vicinity can do the very same thing if conditions are similar. Therefore, I believe that the efforts made by the government of Japan to promote the sugar industry of Formosa will make that island one of the best sugar growing centers of the East. Up to now Japan imports the major part of the raw sugar for her refineries from Java and some other part from the Philippines and from Formosa, but it is the aim of her statesmen to raise all of the sugar in the land itself by the development of Formosa. The Formosa cane is not a very good one, but it is a comparatively easy matter to improve it in a very rapid way, as has been done in Java and the Japanese have studied all the methods carefully, so that what has been done in another country can be done as well in Japan. Week after week I saw them come in Java, the young Japanese students from Formosa, all young, all smiling and all inquisitive and all sure to gather knowledge of every detail both in planting and in manufacturing. When it has been possible in Java to create a considerable cane sugar industry in a country where the land is scarce and expensive and the government officials, as a rule, more inclined to keep back the sugar industry than to promote it, what can we then expect of the prospects of the Formosa industry, when sufficient Japanese or Chinese labor, which is at their very doors can come in and work the land. Moreover the sugar from Java nowhere finds places where to come in at reduced duties and has to pay full duty everywhere, even in the mother country, while it is very probable that Formosa sugar will enjoy large fiscal facilities above foreign sugar when imported or even may come in free in Japan and thus can make a living where foreign sugar must lose money.

As yet the export of Formosa sugar has not come considerably over the figures of former years. The export for 1907 is reported to be 70,000 tons, while the annual production in the years before the Japanese got the island under their control was considered to be 60,000 to 80,000 tons of brown sugar, of which 45,000 to 50,000 were exported. In the last two years, however, such huge shipments of sugar machinery have been sent to Formosa from Great Britain, America and Germany that, as soon as all those factories grind their maximum amount of cane, the production is sure to run up to a considerable height and even with the present consumption of sugar in Japan it may be tripled and then not yet be sufficient to provide all the sugar which Japan can take up. It is superfluous to say that an equal amount of Java sugar will be crowded out in this way and have to look for other markets.

Further, nobody can tell what will happen when the Americans invest money and knowledge in the sugar industry of the Philippines. Already now, with their wasteful methods and small mills the mill owners have succeeded to go on and to make their living. When men with knowledge and capital would go in for sugar making in the Philippines, they could of course do much better than the present manufacturers and where the Java planters can make money even when paying the full duty in America I believe that the Philippine planter can do so too while he has only to pay 75 per cent. of it.

I firmly believe that while Java and Hawaii can continue to produce steadily increasing crops, Formosa and the Philippines will spring up as great sugar producing centers, whereby the islands of the Pacific Ocean will, more than the Antilles have ever been, become the largest suppliers of cane sugar in the world.—*La. Planter.*



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